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JUN 04 2004
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of
Richard R. Haws et al. **Attorney Ref: 13999-1**
Serial No.: 09/589,758 **Group: 2128**
Filed: 06/09/2000 **Examiner: FERRIS III, Fred O.**
For: AUTOMATIC ADAPTIVE DIMENSIONING FOR CAD SOFTWARE

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Honourable Commissioner of Patents
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EVIDENTIARY DECLARATION OF DESMOND J. WALTON

I, Desmond J. Walton, hereby say and declare:

1. I am a professor of computer science at the University of Manitoba, where I have been a member of the faculty since 1984.
2. I have an honours Bachelor of Science degree from the University of South Africa, which I obtained in 1967. I also obtained an M.S. in mathematics from the University of Illinois in 1971. My graduate credentials include a Masters of Science degree and a Ph.D., both in computer science from the University of Manitoba, which I received in 1974 and 1978, respectively.
3. I have worked in the private sector, including spending two years as a computer programmer/analyst for a civil engineering firm in Cape Town, South Africa, in addition to working for four years as a computer programmer/analyst with the Manitoba Department of Highways and Transportation.

4. My present research pursuits include the application of techniques from computer graphics, computer-aided geometric design and numerical analysis to problems in Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM). A sampling of my work is represented by the following selected publications:

 2003, D.J. Walton and D.S. Meek, Planar G^2 transition curves composed of cubic Bézier spiral segments, *Journal of Computational and Applied Mathematics*, **157**, 453-476.

 2003, Madi, Mohsen and Walton, Desmond, An interactive modification data structure for 3D surfaces, *International Journal of Machine Graphics & Vision*, **12**,(3), 293 – 310.

 1999, D.J. Walton and D.S. Meek, Planar G^2 transition between two circles with a fair cubic Bézier curve, *Computer-Aided Design* , **31**, 857-866.

 1998, D.J. Walton and D.S. Meek, Planar G^2 curve design with spiral segments, *Computer-Aided Design* **30**(7), 529-538.

5. Since 1990, I have performed collaborative work on several different projects with Institutes of the National Research Council (NRC), at first with the former Canadian Institute of Industrial Technology (CIIT), and presently with the Integrated Manufacturing Technologies Institute. NRC is a federal organization committed to research and technology transfer to benefit Canadian industries. Particular projects on which I collaborated are:

 1997/99 Smooth surface fitting for rapid prototyping.

 1990/92 Spline techniques for surfaces in CAD/CAM.

 1990/91 Estimation of wear in cylindrical mechanical parts using parametric periodic splines.

6. Additionally, in 1990/91 I spent a sabattical year of research leave with the CIIT, a former NRC institute. It was at this time that my collaborative work

with NRC was initiated by the latter two projects mentioned in the previous paragraph. During this year I was also involved with other projects and consultation on an ad hoc basis, including:

- consultation service in my area of expertise to employees of CIIT
- consultation service in my area of expertise to The Vision Engineering Research Group of Standard Aero, one of CIIT's partners.

7. As a result of my academic and work experience, I have developed particular expertise in computer graphics programming.
8. I currently teach computer science courses at the University of Manitoba, ranging from first year introductory computer programming courses, to graduate level courses which involve such complex subject matter as analysing and displaying curves and surfaces in computer graphics and visualization. By visualization I mean the graphical representation of objects or scientific data on a computer screen using techniques ranging from elementary line drawing to more sophisticated methods involving ray tracing and other ways of hidden-surface removal.
9. In addition to my other activities, I review articles relating to the field of computer graphics and specifically related to CAD/CAM for publication in various international journals. These articles are typically submitted by professionals, either academic or in practice, who use or do research in CAD and computer graphics. I also serve on the editorial board of the Elsevier journal, *Computer-Aided Design* (ISSN: 0010-4485). *Computer-Aided Design* is an established international journal that provides engineers, designers and computer scientists in academia and industry with key papers on research and developments in the application of computers to the design process.
10. I have reviewed, understood and am familiar with U.S. Patent Application No. 09/589,758 which is directed to technology for automatically generating each dimension annotation while creating a CAD drawing, and associating each such annotation with the corresponding target object, as

the target object is created. A copy of the patent application is attached as Schedule A to this Affidavit.

11. In the process of my review of the patent application, I have also reviewed each of claims 1 through 6 on pages 10 through 12 (the "Original Claims"), which I understand were the claims as originally filed.

12. I have also read the claims as amended (the "Amended Claims"). A copy of the Amended Claims is attached as Schedule B.

13. I also understand that the application was originally filed on June 9, 2000.

14. In my view, as of June 9, 2000, the description of the technology in the patent application is and was sufficiently full and complete, clear and concise to enable the programming and use of software capable of performing the methods as claimed in both the Original Claims and the Amended Claims. While programming typically requires routine debugging, no undue or unreasonable experimentation would be needed to reproduce the technology described in the application.

15. It should be understood that it is not typically required to provide excessively detailed information about a software program, in order for another programmer to reproduce it. In many cases, providing the functionality, or the way the software performs, is sufficient. The present patent application clearly describes the features and functions of the software as defined in the Original and Amended Claims, sufficiently for another programmer to reproduce and use it.

16. I am also of the view that the technology described in the application and claimed in the Original Claims and the Amended Claims was neither known nor obvious in view of generally available information as of the June 9, 2000 filing date. I was certainly not aware of such technology in June of 2000.

17. Based on my experience as a professor, I am well aware of the skills and abilities of computer science students within our department. I am specifically of the view that as of June 9, 2000, computer science students at the University of Manitoba during or at the completion of the third year

of their Bachelor's degree (typically a four year program), upon reading the patent application would be able to program and use the software as claimed in the Original and Amended Claims, without needing to obtain additional information from the inventors and without unreasonable experimentation.

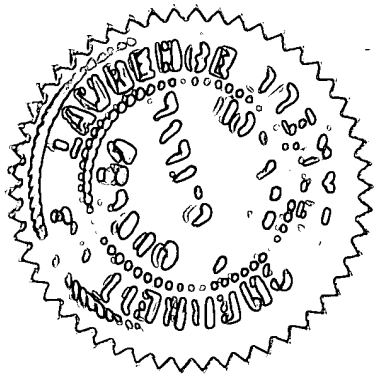
18. I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing therefrom.

SWORN BEFORE ME at the City of Winnipeg, in the Province of Manitoba this 10th day of May, 2004

A Notary Public in and for the Province of Manitoba

Desmond J. Walton

DESMOND J. WALTON



SCHEDULE "A"

AUTOMATIC ADAPTIVE DIMENSIONING FOR CAD SOFTWARE

Field of the Invention

This invention relates to computer software. In particular, this invention relates to an improvement in computer aided design (CAD) software.

Background of the Invention

There are many types of computer aided design (CAD) software which assist in architectural design and drafting. Such software is widely used, as it considerably simplifies the task of drafting plans to scale with such annotations as are required for the needs of the user.

One of the advantages of CAD software is a feature whereby an object can have dimension annotations associated with the object, including dimension lines, extension lines, symbols of termination (e.g. arrowheads, architectural ticks) and dimension text, created automatically. Thus, the dimension can be automatically created for an object as the object is drawn. This considerably simplifies the annotation of the drawing, which had previously had been a very time consuming process.

Some CAD programs allow manual associative dimensioning, by which a dimension annotation can be manually associated with an object, and thereafter if the object is moved the dimension annotation adjusts automatically with the object. This also facilitates the annotation of drawings, however it requires that the user manually attach the dimension to the object in order for changes in the object to be reflected in the associated dimension annotation. Furthermore, if the object is broken, for example if another object is interposed in or superposed onto an intermediate point of the existing object, the associative dimensioning cannot accommodate the new object and new dimensions, so new dimension annotations corresponding to the new object must be manually added and new associations must be established between the existing dimension annotation and the remaining portions of the existing object. This is a time consuming process, particularly during the modification stages of CAD drafting.

For example, adding a window to an existing wall in a CAD drawing requires that the window be inserted at the intended position, that the existing dimension annotations be deleted and that new extension lines, dimension lines, termination symbols and dimension text be created to reflect the new segmentation of the object and/or the addition of any new object (or the removal of an existing object).

It would accordingly be advantageous if dimension annotations were created automatically as objects are created, and automatically associated with the objects as they are created. It would further be advantageous if dimension annotations would change automatically to accommodate any change to the existing objects, such as a new object inserted into a selected position relative to the existing objects or the deletion of an object from a group of objects.

Summary of the Invention

The present invention overcomes these disadvantages by providing automatic adaptive dimensioning in a CAD software program. According to the invention, dimension annotations are created by the CAD program automatically as an object is drawn and automatically associated with the target object. Thereafter, changing the length of the target object automatically changes the associated dimension annotation, or alternatively, changing the associated dimension annotation automatically changes the length of the target object. Further, changing the dimension annotation associated with an adjacent object automatically changes the position of the target object.

Moreover, when another object is inserted into an intermediate position of an existing object, the automatic adaptive dimensioning feature of the invention automatically creates dimension annotations corresponding to the position of the new object relative to the existing object; likewise, the new object can be automatically positioned in relation to the existing object by specifying interposition dimensions or segment lengths in the existing dimension annotations. Thereafter, any changes to the lengths or relative positions of the objects will automatically change the associated dimension annotations, and any changes made to the associated dimension annotations will automatically change the lengths and/or relative positions of the objects.

Incorporating the automatic adaptive dimensioning feature of the invention into a CAD program accordingly substantially decreases the production time of architectural drawings. The commensurate savings in labour, particularly in the input, documentation and modification stages of drawing preparation, provides a considerable advantage over conventional CAD drawing programs.

These and other features of the invention will be apparent from the detailed description which follows.

The present invention thus provides a method of annotating a computer aided design drawing, comprising the steps of a. setting parameters of dimension annotations comprising one or more of dimension text, dimension lines, extension lines and termination symbols, b. creating a target object by selecting a length of the target object; and c. automatically generating dimension annotations corresponding to the target object, whereby the dimension annotations are associated with the target object such that in response to a modification of a length or relative position of the target object, the dimension annotations associated with the target object or the dimension annotation associated with at least one adjacent object, or both, are automatically adjusted to correspond to the modification of the length or relative position of the target object.

The present invention further provides a computer program product for use with a computer, the computer program product comprising a computer usable medium having computer readable program code means embodied in said medium for annotating a computer aided design drawing, said computer program product having computer readable program code means for setting parameters of dimension annotations comprising one or more of dimension text, dimension lines, extension lines and termination symbols, computer readable program code means for creating a target object by selecting a length of the target object; and computer readable program code means for automatically generating dimension annotations corresponding to the target object, whereby the dimension annotations are associated with the target object such that in response to a modification of a length or relative position of the target object, the dimension annotations associated with the target object or the dimension

annotation associated with at least one adjacent object, or both, are automatically adjusted to correspond to the modification of the length or relative position of the target object.

The present invention further provides a program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for annotating a computer aided design drawing, said method steps comprising: a. setting parameters of dimension annotations comprising one or more of dimension text, dimension lines, extension lines and termination symbols, b. creating a target object by selecting a length of the target object; and c. automatically generating dimension annotations corresponding to the target object, whereby the dimension annotations are associated with the target object such that in response to a modification of a length or relative position of the target object, the dimension annotations associated with the target object or the dimension annotation associated with at least one adjacent object, or both, are automatically adjusted to correspond to the modification of the length or relative position of the target object.

A further aspect of the invention includes the step of, in response to a modification of the dimension annotation associated with the target object or the dimension annotation associated with at least one adjacent object or both, automatically modifying a length or relative position of the target object to correspond to the modification of the dimension annotation.

Brief Description of the Drawings

In drawings which illustrate by way of example only a preferred embodiment of the invention,

Figure 1 is a diagrammatic illustration of objects and associated dimension annotations in a conventional CAD drawing,

Figure 2 is a diagrammatic illustration of an object and associated dimension annotations in a CAD drawing using the method of the invention,

Figure 3 is a diagrammatic illustration of the drawing of Figure 2 after inserting a new object,

Figure 4 is a diagrammatic illustration of the drawing of Figure 3 after inserting a new object,

Figure 5 is a diagrammatic illustration of the drawing of Figure 4 after inserting a new object,

Figure 6 is a diagrammatic illustration of the drawing of Figure 5 after inserting a new object,

Figure 7 is a diagrammatic illustration of the drawing of Figure 6 after inserting a new object,

Figure 8 is a diagrammatic illustration of the drawing of Figure 7 after inserting a new object,

Figure 9 is a diagrammatic illustration of the drawing of Figure 8 after inserting a new object,

Figure 10 is a diagrammatic illustration of the drawing of Figure 9 after moving an existing object, and

Figure 11 is a diagrammatic illustration of the drawing of Figure 10 after deleting an object.

Detailed Description of the Invention

Figure 1 illustrates an architectural drawing by way of example. In a conventional CAD drawing program, line objects representing walls 10 and a windows 12 which are drawn or inserted in the CAD environment. Dimension text 20 specifying the lengths and relative positions of the objects 10, 12 are entered by the user, and in some CAD programs may be thereafter manually associated with each respective object 10, 12, so that a change in the length of the object is automatically reflected in the associated dimension text 20. Extension lines 22 are positioned or picked (selected) by the user for the desired dimension text, and dimension lines 24

and termination symbols 26 such as architectural ticks are either manually created by the user, or generated based on user-defined settings, based on the selected positions of the extension lines 22.

According to the invention, the dimension annotations are automatically created and associated with the respective objects to which they relate, and thereafter these dimension annotations are adaptive. Thus, the interposition or superposition of a new object in or onto an existing object automatically results in new extension lines 22 at the extremities of the new object, parsing of the existing dimension line 24 into segments with selected termination symbols 26, and the repositioning and recalculation of dimension text to accommodate the new object.

In use, to create a horizontal or vertical dimension associated with an object 10, 12, the object dimension text 20 can be selected by clicking, picking or otherwise specifying first and second points representing the ends of the object 10 or 12. In the case of multiple dimension strings, the locations of the dimension lines 24 (for example baseline strings or aligned strings) are also specified by the initial user settings, as are extension lines 22 and dimension text 20, with the selected termination symbols 26, which are thereafter generated automatically by the adaptive dimensioning feature of the invention based on the coordinate positions selected for the object. This feature of the invention also automatically trims or extends the dimensions annotations in response to a change in the size or position of the associated target object.

Thereafter, modifications to the existing objects 10, 12, may be made in two ways:

1. By modifying the length of the target object 8 itself and/or moving the target object to a new position relative to other objects. In this situation the associated dimension annotations automatically change to adapt to the modification of the associated object's dimension and/or position, moving extension lines, arrowheads or other termination symbols, and dimension text as necessary to accommodate the modification.

2. By changing dimension text to specify a new length for the target object 8, and/or changing the dimension text of an adjacent object to reposition the target object. In this case, the length of the object whose associated dimension text has been modified changes to correspond to the modified dimension. If the length of an adjacent object is changed, the target object is repositioned to remain adjacent to the adjacent object.

Specifics of the extension lines 22, alignment of dimension lines 24 (e.g. as aligned or baseline), type of termination symbols (e.g. architectural ticks), size and placement of dimension text 20, and any other desired parameters, are selected as setup parameters by the user before commencing drawing. The CAD drawing will automatically adaptively associate dimension annotations having the predefined parameters with the respective objects as they are inserted, deleted or modified.

Thus, in the example shown as a series of drawing steps in Figures 2 to 11, a target object 8, in Figure 2 being a wall 10a, is inserted into a new CAD drawing by selecting points 11a and 11b. Dimension annotations are automatically created by the method and computer program of the invention, by creating extension lines 22a aligned with the extremities of the target object 10a, creating a dimension line 24a with termination symbols 26a at its ends and creating dimension text 20a adjacent to the dimension line 24a (or as otherwise specified by the user in the setup parameters).

In Figure 3 the target object 8 is a new exterior wall 10b, added to the drawing of Figure 2 by selecting point 11c. Again dimension annotations are automatically created for the target object by aligning extension lines 22b with the extremities of the target object 8, creating a dimension line 24b with termination symbols 26b at its ends and creating dimension text 20b adjacent to the dimension line 24b. When a new target object 8 is created, for example another exterior wall 10c, by selecting point 11d, as shown in Figure 4, in addition to automatically creating dimension annotations for the new exterior wall 10c, the position of the dimension annotations for the previous object are automatically shifted to accommodate the new target object 8.

Figures 5, 6 and 7 each add a further target object 8, in each case an exterior wall 10d, 10e and 10f, by the selection of points 11e, 11f and 11a, respectively, to delimit the exterior of the structure, and in each case dimension annotations are automatically created for each target object 8 as the target object 8 is inserted, by creating extension lines 22d, 22e, 22f aligned with the extremities of the walls 10d, 10e and 10f, creating dimension lines 24d, 24e, 24f with termination symbols 26d, 26e, 26f at their respective ends and creating dimension text 20d, 20e, 20f adjacent to the respective dimension lines 24d, 24e, 24f.

In Figure 8 a target object 8 comprising a partition wall 10g is added to the drawing of Figure 7 by selecting points 11h and 11j. In this case the adaptive feature of the invention automatically creates extension lines 22g at the appropriate points on the existing dimension lines 24a, 24f, parses the existing dimension lines 24a, 24f into segments 24g, and deletes the existing dimension text 20a, 20f and replaces it with new dimension text 20g relating to the newly created dimension line segments 24g. Similarly, when a target object 8 comprising a window 12 is added in Figure 9, the adaptive dimensioning feature of the invention automatically creates a new dimension line 24h (as specified by the user in the setup parameters) at the window 12 having an on-center extension line 22h with associated dimension text 20h and termination symbols 26h.

In Figure 10, the target object 8 is wall 10c adjacent to the wall 10d with the window 12. Wall 10c is repositioned by dragging the wall 10c to a new position from the previous position (shown in phantom lines). The automatic adaptive dimensioning feature of the invention automatically moves all associated extension lines 22b, 22d to align with the repositioned wall 10c, and replaces the existing dimension text 20b, 22d of the resized walls 10b, 10d with new dimension text 20b, 20d reflecting the new position of the wall 10c relative to adjacent objects. The lengths of walls 10b, 10d adjacent to the target object 8 (wall 10c) automatically adjust to the new position of wall 10c.

To complete the drawing, in Figure 11 the partition wall 10g (shown in phantom lines) has been deleted. The automatic adaptive dimensioning feature of the

invention deletes the extension lines 22 previously associated with the partition 10g to reconstitute the original dimension lines 24f, deletes the dimension text 20g of the parsed dimension line segments 24g, and restores the original dimension text 24f (from Figure 7).

Thus, the invention provides an automatic adaptive dimensioning feature in a CAD program which automatically creates and associates dimension annotations as an object is inserted into a drawing, and modifies the dimension annotations as an object is added, deleted or modified in the drawing. The invention thus provides a method of creating and modifying a CAD drawing which considerably simplifies the CAD documentation process.

The automatic adaptive dimensioning feature of the invention can be programmed into CAD software, or can be created as an independent program loaded as a "plug-in" for existing CAD software.

A preferred embodiment of the present invention having been thus described by way of example, variations and modifications will be apparent to those skilled in the art. The invention includes all such variations and modifications as fall within the scope of the appended claims.

I CLAIM:

1. A method of annotating a computer aided design drawing, comprising the steps of

a. setting parameters of dimension annotations comprising one or more of dimension text, dimension lines, extension lines and termination symbols,

b. creating a target object by selecting a length of the target object; and

c. automatically generating dimension annotations corresponding to the target object,

whereby the dimension annotations are associated with the target object such that in response to a modification of a length or relative position of the target object, the dimension annotations associated with the target object or the dimension annotation associated with at least one adjacent object, or both, are automatically adjusted to correspond to the modification of the length or relative position of the target object.

2. The method of claim 1 further including the step:

d. in response to a modification of the dimension annotation associated with the target object or the dimension annotation associated with at least one adjacent object or both, automatically modifying a length or relative position of the target object to correspond to the modification of the dimension annotation.

3. A computer program product for use with a computer, the computer program product comprising a computer usable medium having computer readable program code means embodied in said medium for annotating a computer aided design drawing, said computer program product having

computer readable program code means for setting parameters of dimension annotations comprising one or more of dimension text, dimension lines, extension lines and termination symbols,

computer readable program code means for creating a target object by selecting a length of the target object; and

computer readable program code means for automatically generating dimension annotations corresponding to the target object,

whereby the dimension annotations are associated with the target object such that in response to a modification of a length or relative position of the target object, the dimension annotations associated with the target object or the dimension annotation associated with at least one adjacent object, or both, are automatically adjusted to correspond to the modification of the length or relative position of the target object.

4. The computer program product of claim 3, further comprising computer readable program code means for in response to a modification of the dimension annotation associated with the target object or the dimension annotation associated with at least one adjacent object or both, automatically modifying a length or relative position of the target object to correspond to the modification of the dimension annotation.

5. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for annotating a computer aided design drawing, said method steps comprising:

a. setting parameters of dimension annotations comprising one or more of dimension text, dimension lines, extension lines and termination symbols,

b. creating a target object by a length of the target object; and

c. automatically generating dimension annotations corresponding to the target object,

whereby the dimension annotations are associated with the target object such that in response to a modification of a length or relative position of the target object, the dimension annotations associated with the target object or the dimension

annotation associated with at least one adjacent object, or both, are automatically adjusted to correspond to the modification of the length or relative position of the target object.

6. The program storage device of claim 5, further including a method step comprising:

d. in response to a modification of the dimension annotation associated with the target object or the dimension annotation associated with at least one adjacent object or both, automatically modifying a length or relative position of the target object to correspond to the modification of the dimension annotation.

Abstract

An automatic adaptive dimensioning program for CAD software in which dimension annotations are created by the CAD program automatically as an object is drawn and automatically associated with the object. Thereafter, changing the length of the object automatically changes the associated dimension annotation, or alternatively, changing the associated dimension annotation automatically changes the length of the object. When another object is interposed into or superposed onto an intermediate position of the existing object, the automatic adaptive dimensioning annotation feature of the invention automatically creates dimension annotations corresponding to the position of the new object relative to the existing object. The new object can be automatically positioned in relation to the existing object by specifying interposition dimensions or segment lengths in the dimension annotations.

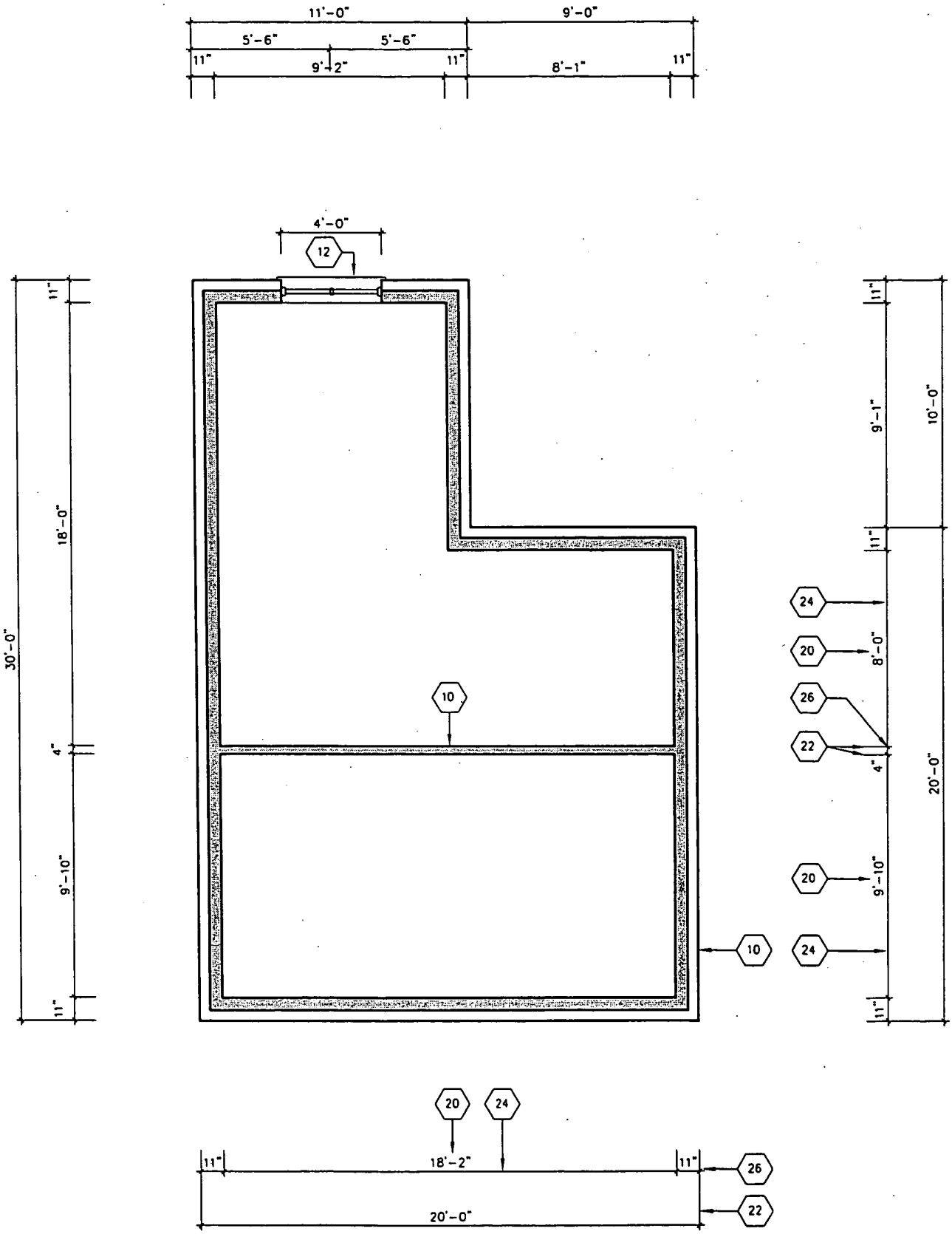

11'-0"
9'-0"
5'-6"
5'-6"
11"
9'-2"
11"
8'-1"
11"
4'-0"
12
11"
18'-0"
4"
9'-10"
11"
30'-0"
10
10
11"
9'-1"
11"
10'-0"
24
20
8'-0"
26
22
4"
20'-0"
20
9'-10"
24
11"
20
24
11"
18'-2"
11"
26
22
20'-0"

figure 1

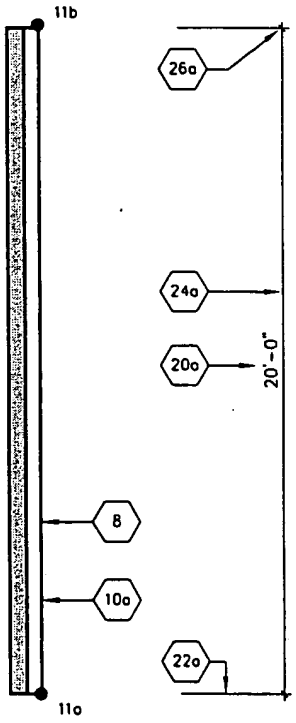


figure 2

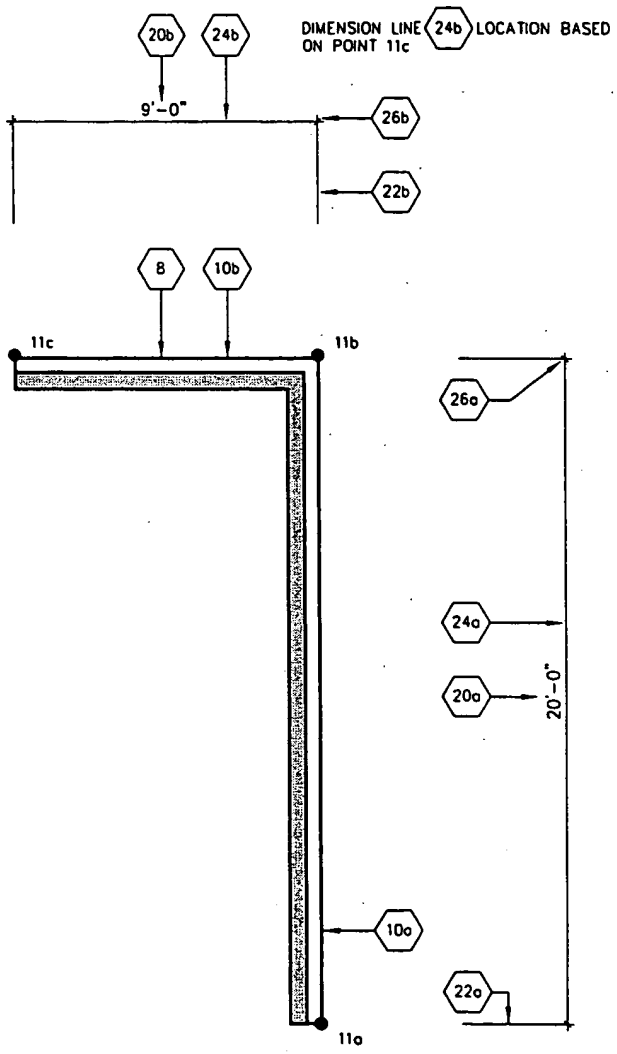

20b
24b
DIMENSION LINE ON POINT 11c
24b
LOCATION BASED
9'-0"
26b
22b
8
10b
11c
11b
26a
24a
20a
20'-0"
10a
22a
11a

figure 3

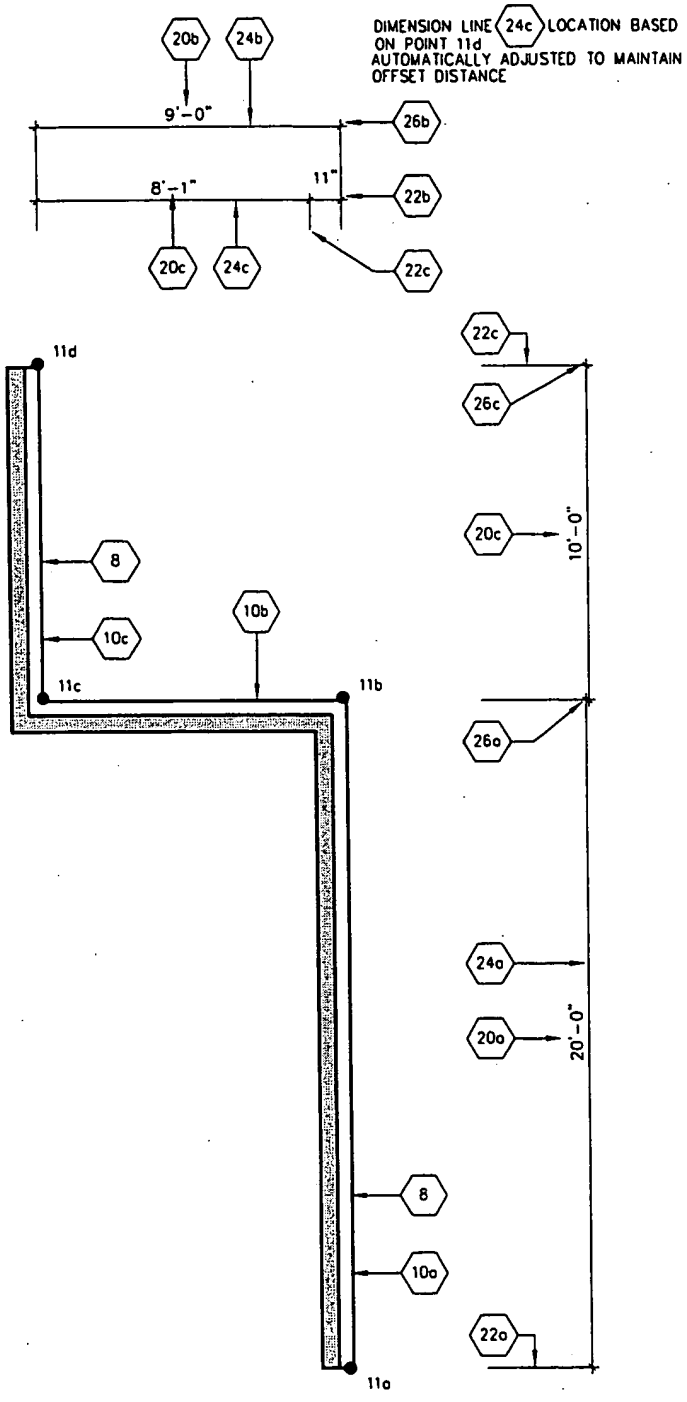

DIMENSION LINE 24c LOCATION BASED ON POINT 11d AUTOMATICALLY ADJUSTED TO MAINTAIN OFFSET DISTANCE
20b
24b
9'-0"
26b
8'-1"
11"
22b
20c
24c
22c
11d
22c
26c
20c
10'-0"
8
10b
10c
11c
11b
26a
24a
20a
20'-0"
8
10a
22a
11a

figure 1

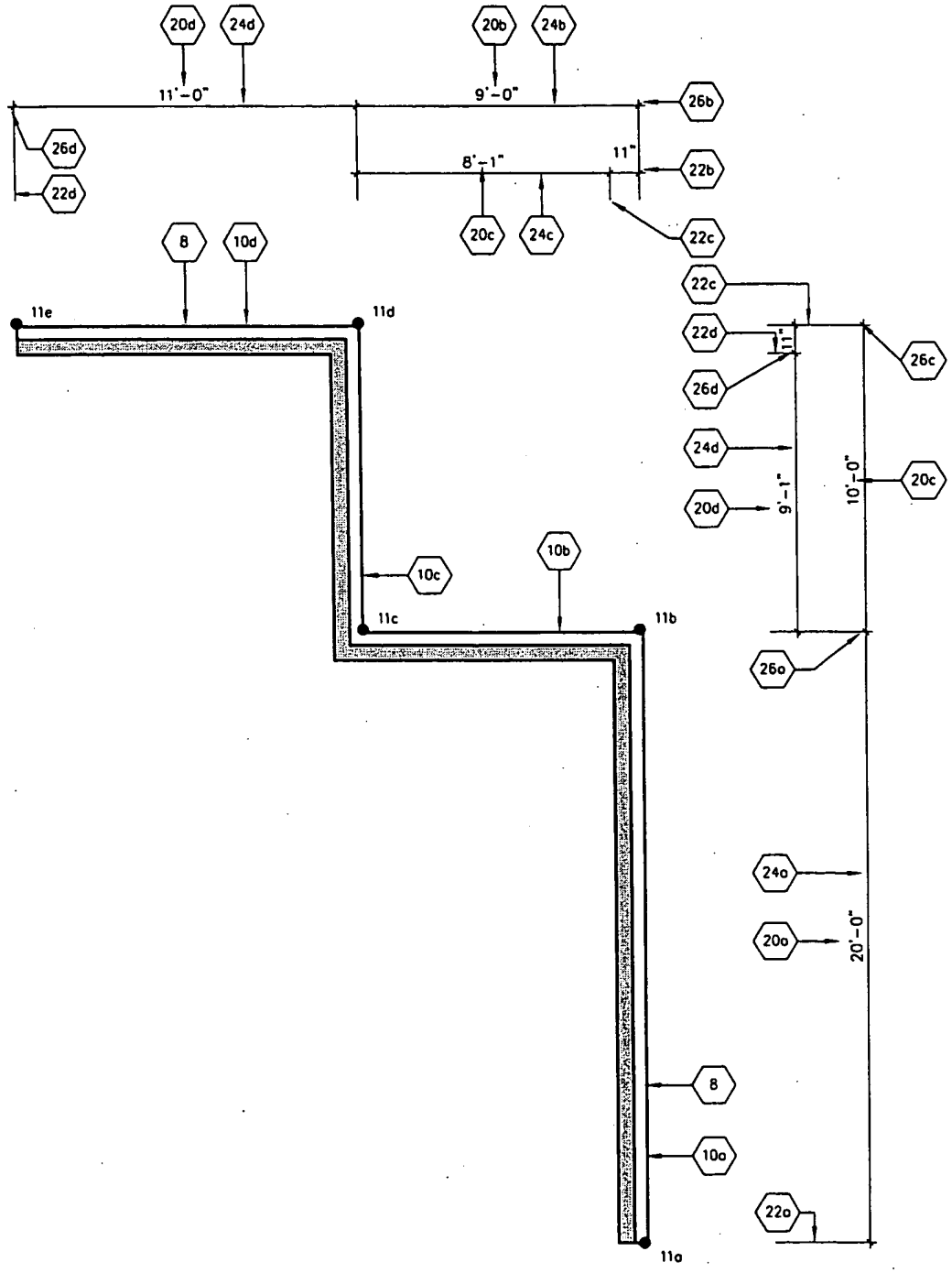
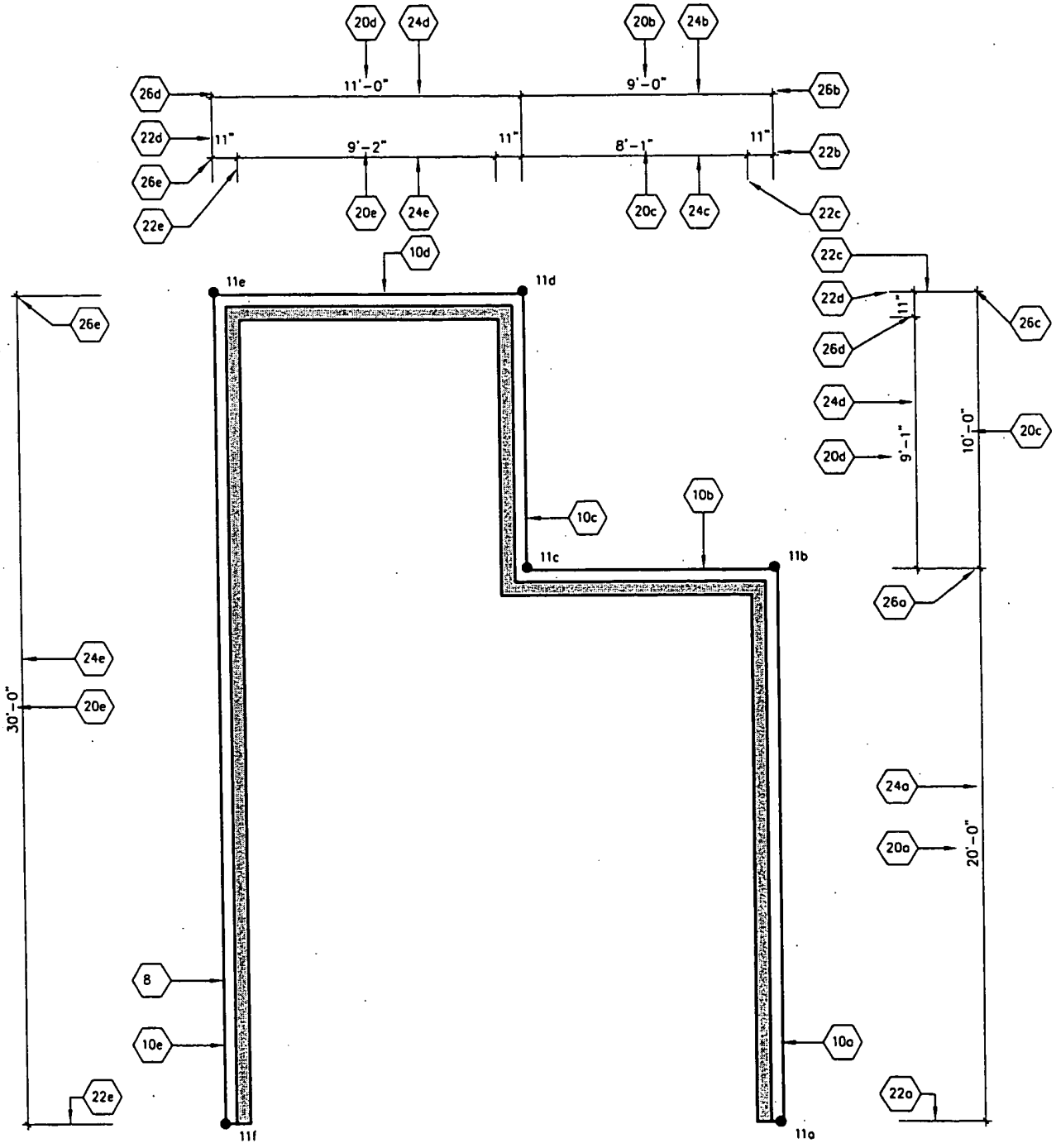

20d
24d
11'-0"
20b
24b
9'-0"
26b
26d
22d
8'-1"
11"
22b
20c
24c
22c
8
10d
11e
11d
22c
22d
1'-1"
26c
26d
24d
20d
9'-1"
10'-0"
20c
10b
10c
11c
11b
26a
24a
20a
20'-0"
8
10a
22a
11a

figure 5


20d
24d
20b
24b
11'-0"
9'-0"
26d
26b
22d
11"
9'-2"
11"
8'-1"
11"
22b
26e
22e
20e
24e
20c
24c
22c
10d
11e
11d
22c
22d
11"
26c
26d
24d
20d
9'-1"
10'-0"
20c
26e
10c
10b
11c
11b
26a
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20e
24a
20a
20'-0"
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22e
22a
11f
11a

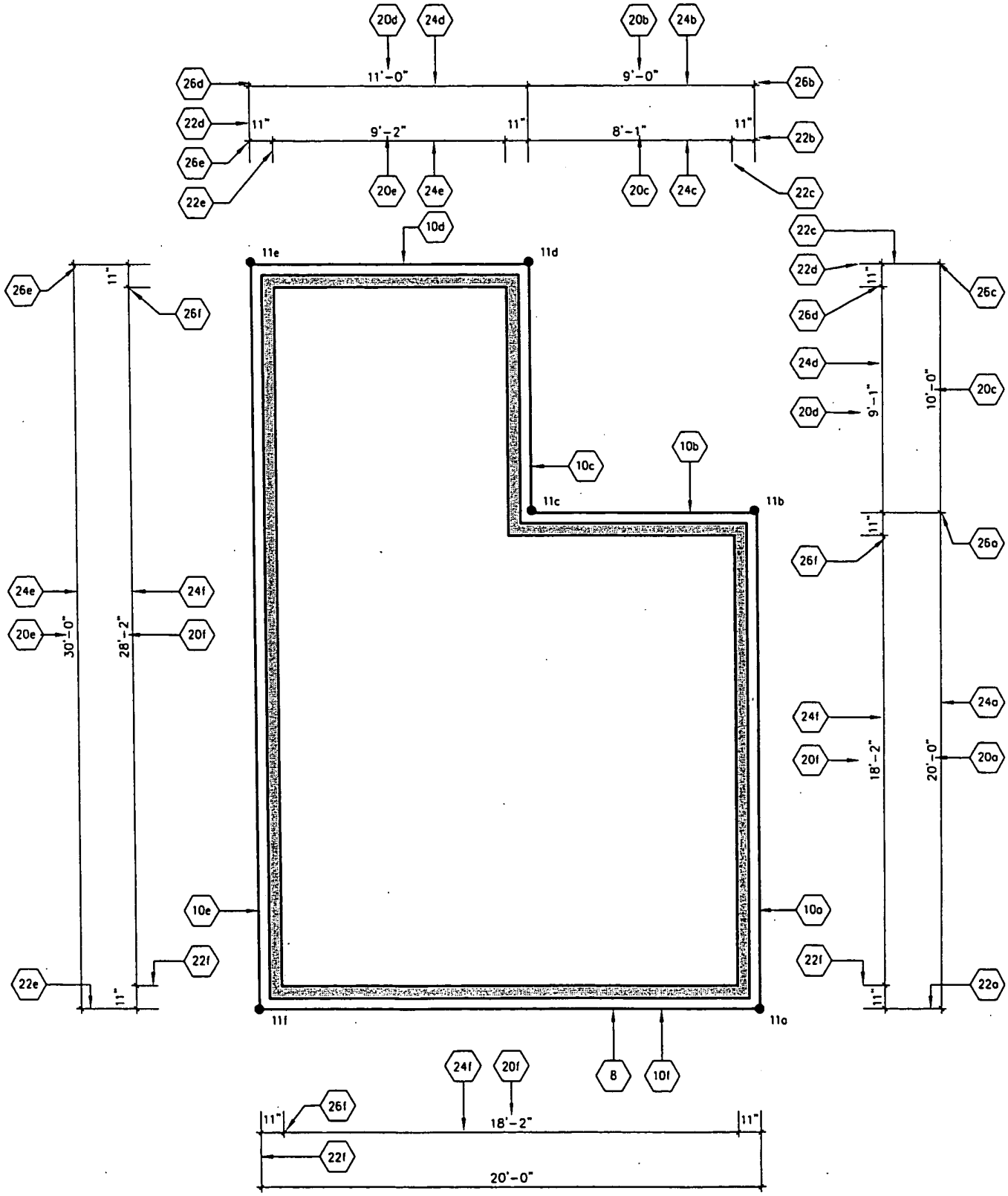

20d
24d
20b
24b
11'-0"
9'-0"
26d
26b
22d
11"
9'-2"
11"
8'-1"
11"
22b
26e
22e
20e
24e
20c
24c
22c
10d
11e
11d
22c
22d
11"
26c
26d
24d
20d
9'-1"
10'-0"
20c
10b
10c
11c
11b
26e
11"
26f
26f
11"
26a
24e
24f
30'-0"
28'-2"
20e
20f
24f
24a
20f
18'-2"
20'-0"
20a
10e
10a
22f
22f
22e
11"
22a
11"
11f
11a
24f
20f
8
10f
11"
26f
18'-2"
11"
22f
20'-0"

figure 7

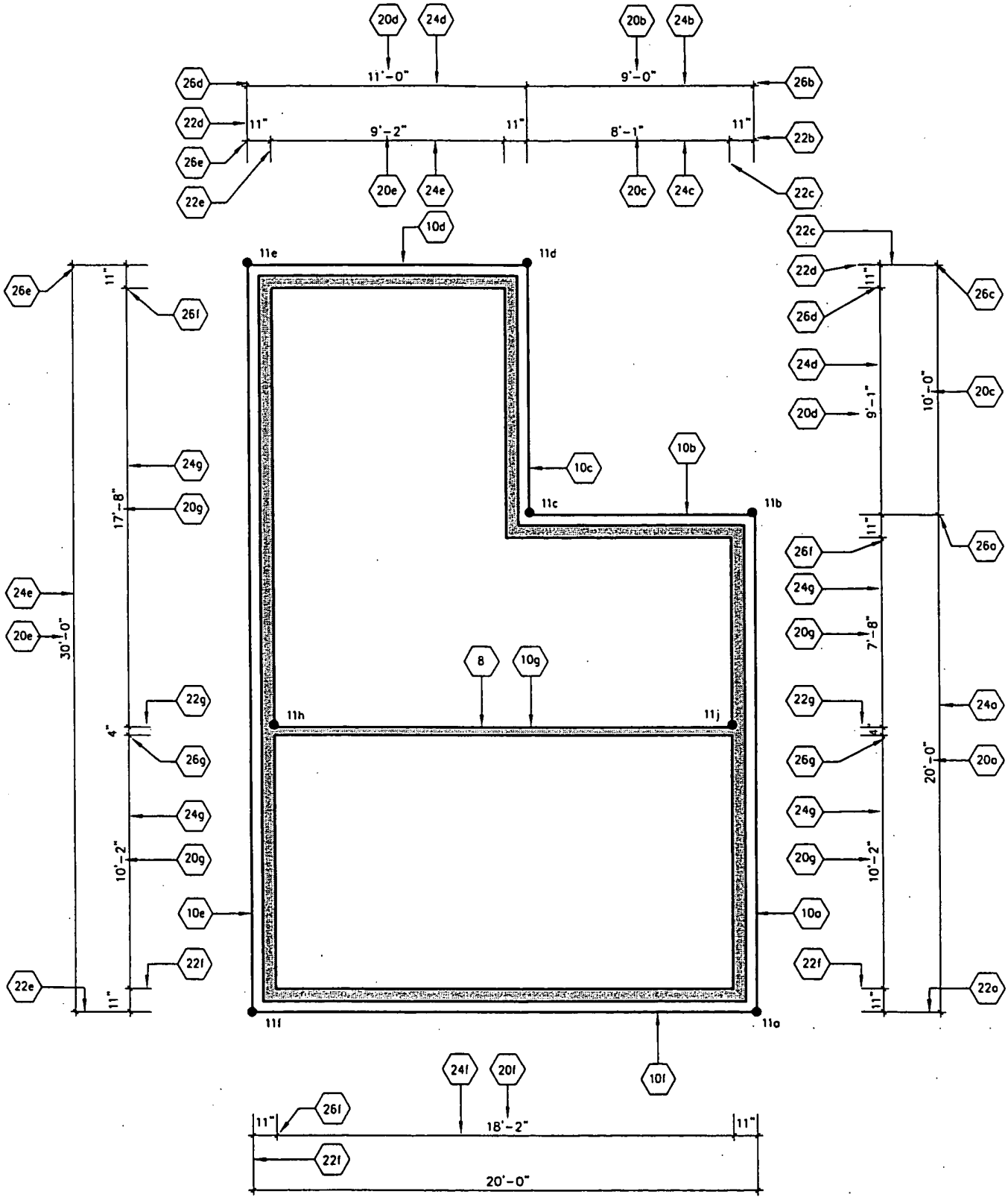

20d
24d
20b
24b
11'-0"
9'-0"
26d
26b
22d
11"
9'-2"
11"
8'-1"
11"
22b
26e
22e
20e
24e
20c
24c
22c
10d
11e
11d
22c
22d
26e
11"
26f
26d
26c
24d
24g
20d
9'-1"
10'-0"
20c
10c
10b
20g
17'-8"
11c
11b
11"
26a
26f
24e
24g
20e
30'-0"
20g
7'-8"
8
10g
22g
24a
11h
11j
4"
26g
26g
20a
24g
24g
20g
10'-2"
20g
10'-2"
10e
10a
22f
22e
22f
22a
11"
11"
11f
11a
24f
20f
10f
26f
11"
18'-2"
11"
22f
20'-0"

figure 8

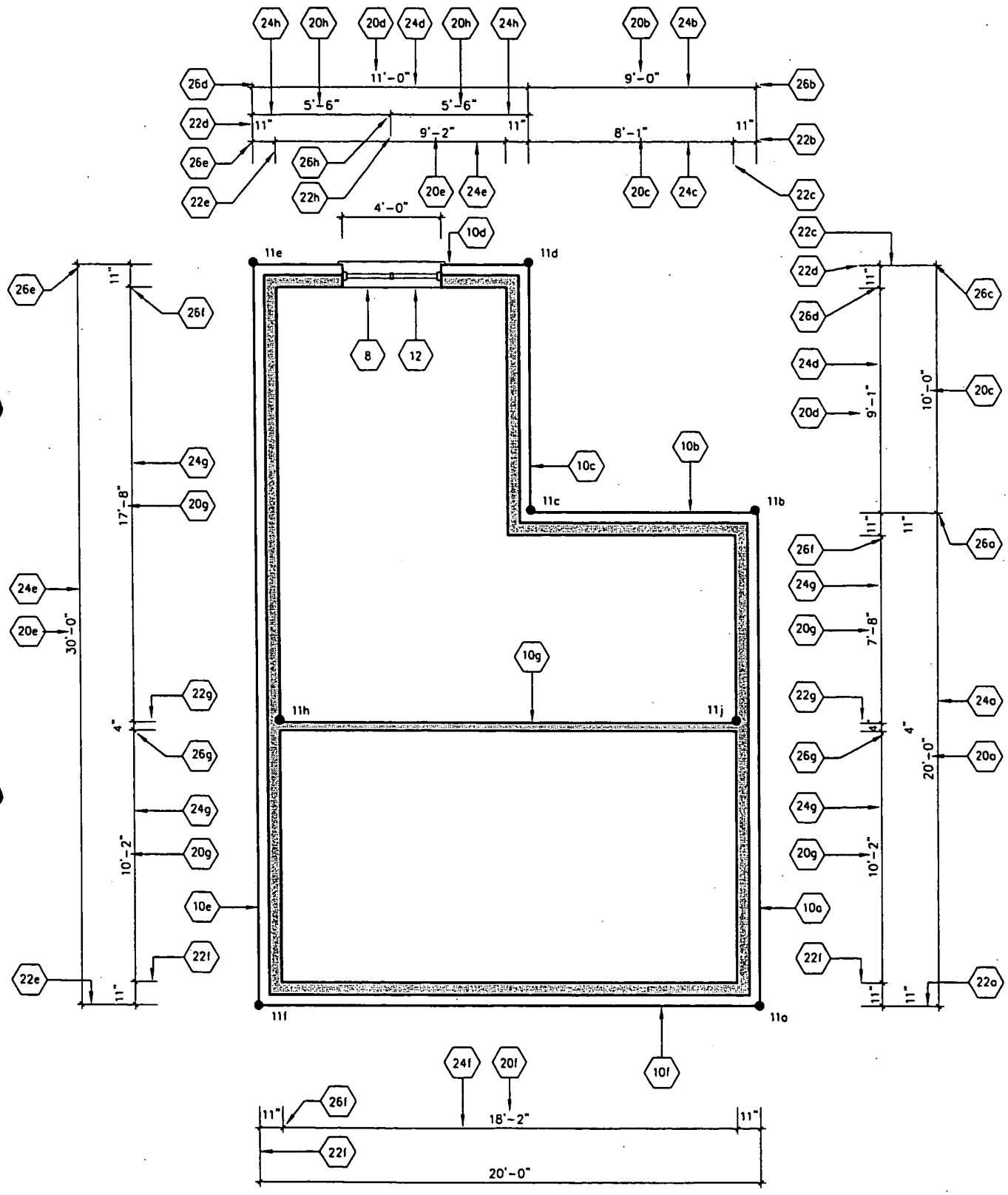
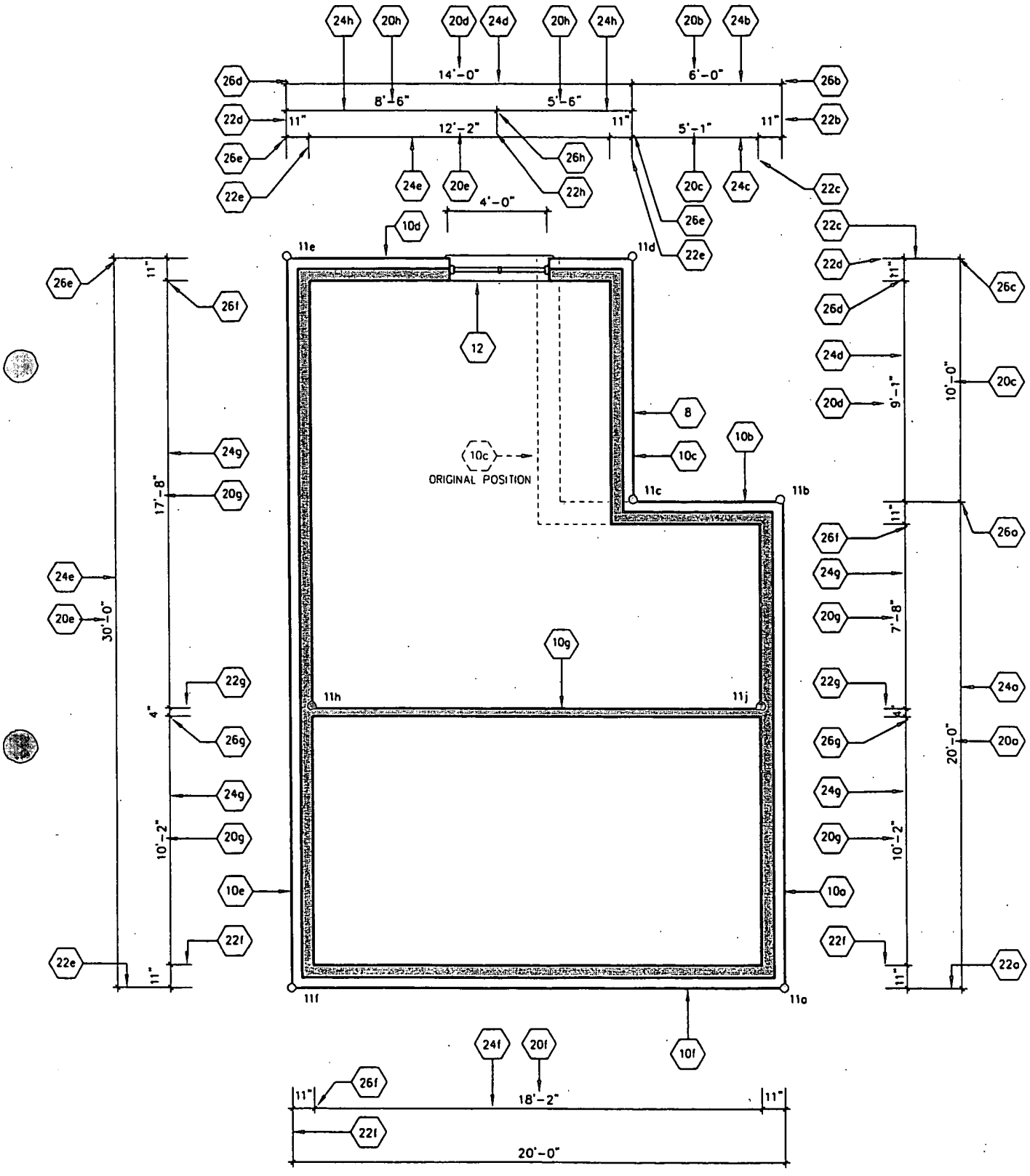

24h
20h
20d
24d
20h
24h
20b
24b
26d
26b
11'-0"
9'-0"
5'-6"
5'-6"
22d
11"
11"
11"
22b
9'-2"
8'-1"
26e
26h
22h
20e
24e
20c
24c
22e
22c
4'-0"
10d
11e
11d
22c
22d
26e
11"
26f
8
12
26d
26c
24d
10'-0"
20c
9'-1"
20d
24g
10c
10b
20g
17'-8"
11c
11b
11"
11"
26a
26f
24e
24g
20e
30'-0"
20g
7'-8"
10g
22g
24a
11h
11j
4"
4"
26g
20'-0"
20a
26g
24g
24g
20g
10'-2"
20g
10'-2"
10e
10a
22f
22f
22e
11"
11"
22a
11f
11a
10f
24f
20f
26f
11"
18'-2"
11"
22f
20'-0"

figure 9


24h
20h
20d
24d
20h
24h
20b
24b
14'-0"
6'-0"
26d
26b
8'-6"
5'-6"
22d
11"
11"
11"
22b
12'-2"
5'-1"
26e
26h
24e
20e
22h
20c
24c
22c
22e
4'-0"
10d
26e
22e
11e
11d
22c
22d
11"
26c
26d
26f
12
24d
20d
9'-1"
10'-0"
20c
8
10b
24g
10c
ORIGINAL POSITION
17'-8"
20g
11c
11b
26f
11"
26a
24e
24g
20e
20g
30'-0"
7'-8"
10g
22g
24a
11h
11j
4"
4"
26g
26g
20'-0"
20a
24g
24g
20g
20g
10'-2"
10'-2"
10e
10a
22f
22f
22e
11"
11"
22a
11f
11a
24f
20f
10f
11"
26f
18'-2"
11"
22f
20'-0"

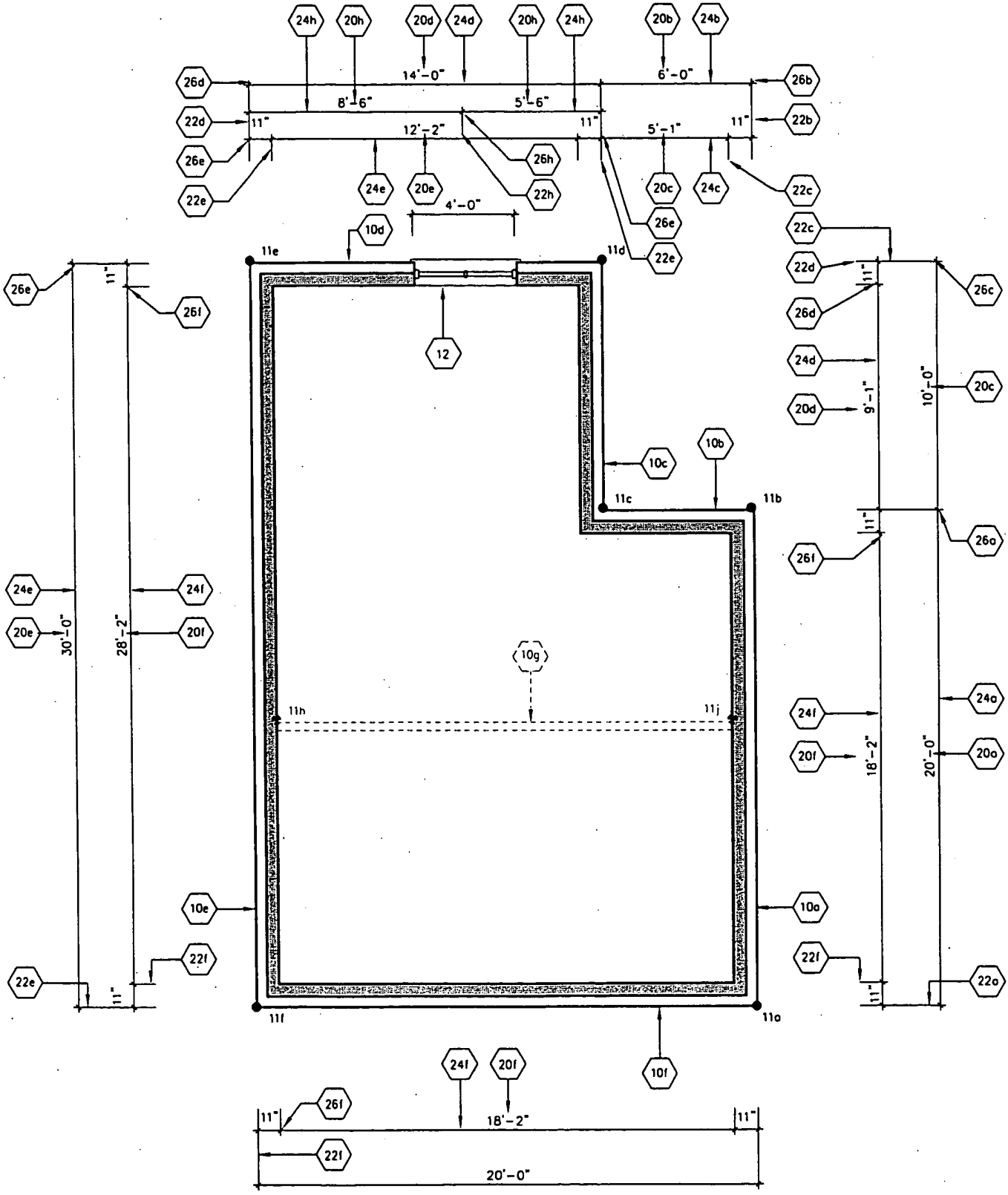

24h
20h
20d
24d
20h
24h
20b
24b
26d
14'-0"
6'-0"
26b
8'-6"
5'-6"
22d
11"
11"
11"
22b
12'-2"
5'-1"
26e
26h
24e
20e
22h
20c
24c
22c
22e
4'-0"
10d
26e
22e
22c
11e
11d
22d
26e
11"
26c
26f
12
26d
24d
9'-1"
10'-0"
20c
20d
10c
10b
11c
11b
11"
26a
26f
24e
24f
30'-0"
28'-2"
20e
20f
10g
11h
11j
24f
24a
20f
18'-2"
20'-0"
20a
10e
10a
22f
22f
22e
22a
11"
11"
11f
11a
10f
24f
20f
11"
26f
18'-2"
11"
22f
20'-0"

figure 11

SCHEDULE "B"

1. A method for creating a computer aided design drawing formed of a plurality of target objects, comprising the steps of:

 (a) inputting first coordinate position data;

 (b) displaying a first target object corresponding to the first coordinate position data;

 (c) creating first dimension annotation data correlated to the first coordinate position data;

 (d) displaying a first dimension annotation correlated to the first dimension annotation data; and

 (e) cross-associating the first target object with the first dimension annotation, wherein as a result of such cross-association:

 (i) a change in the first coordinate position data will effect a correlated change in the first dimension annotation data; and

 (ii) a change in the first dimension annotation data will effect a correlated change in the first coordinate position data.

2. The method of claim 1 further comprising the steps of:

 (f) subsequent to step (e), inputting further coordinate position data corresponding to at least one further target object;

 (g) displaying the further target object in accordance with the further coordinate position data;

 (h) creating further dimension annotation data correlated to the further coordinate position data;

 (i) displaying a further dimension annotation correlated to the further dimension annotation data

 (j) cross-associating the at least one further target object with the further dimension annotation, wherein as a result of such cross-association:

(i) a change in the further coordinate position data will effect a correlated change in the further dimension annotation data; and

(ii) a change in the further dimension annotation data will effect a correlated change in the further coordinate position data;

3. The method of claim 2, further comprising the step of:

(k) determining if the at least one further target object intersects the first target object

(l) wherein if the at least one further target object intersects the first target object into a first segment and a second segment:

(i) calculating first segment coordinate position data;

(ii) calculating second segment coordinate position data;

(iii) creating first segment dimension annotation data correlated to the first segment coordinate position data;

(iv) displaying a first segment dimension annotation correlated to the first segment annotation data;

(v) creating second segment dimension annotation data correlated to the second segment coordinate position data;

(vi) displaying a second segment dimension annotation correlated to the second segment annotation data;

(vii) cross-associating the first segment with the first segment dimension annotation; and

(viii) cross-associating the second segment with the second segment dimension annotation.

4. The method of claim 2, further comprising the step of:

(m) determining if the at least one further target object is adjacent to any other target object.

5. The method of claim 4, further comprising the step of:

(n) inputting modifications to the further coordinate position data;

(o) displaying the further target object in accordance with the modified further coordinate position data;

(p) creating modified further dimension annotation data correlated to the modified further coordinate position data; and

(q) displaying a modified further dimension annotation correlated to the further dimension annotation data.

6. The method of claim 5, further comprising the steps of:

(r) if the at least one further target object is adjacent to the first target object:

(i) modifying the first coordinate position data in correlation to the modified further coordinate position data;

(ii) displaying the first target object in accordance with the modified first coordinate position data;

(iii) modifying the first dimension annotation data correlated to the modified first coordinate position data;

(iv) displaying a first dimension annotation correlated to the modified first dimension annotation data

7. A method for creating a computer aided design drawing formed of a plurality of target objects, comprising the steps of:

(a) inputting coordinate position data for a new target object;

(b) displaying the new target object corresponding to the coordinate position data;

(c) creating dimension annotation data correlated to the coordinate position data;

(d) displaying a dimension annotation correlated to the dimension annotation data;

(e) cross-associating the new target object with the dimension annotation, wherein in said cross-association:

(i) a change in the coordinate position data will effect a correlated change in the dimension annotation data; and

(ii) a change in the dimension annotation data will effect a correlated change in the coordinate position data;

(f) repeating steps (a) through (e) for at least one additional target object;

(g) wherein all of steps (a) through (e) are completed for one target object prior to inputting coordinate position data for any additional target object.

8. The method of claim 7, wherein step (a) further comprises the steps of:

(a) determining whether the new target object intersects any other target object; and

(b) wherein if the new target object intersects at least one other target object so as to create a first segment and a second segment:

(i) calculating first segment coordinate position data,

(ii) calculating second segment coordinate position data,

(iii) creating first segment dimension annotation data correlated to the first segment coordinate position data,

(iv) displaying a first segment dimension annotation correlated to the first segment annotation data,

(v) creating second segment dimension annotation data correlated to the second segment coordinate position data,

(vi) displaying a second segment dimension annotation correlated to the second segment annotation data,

(vii) cross-associating the first segment with the first segment dimension annotation, and

(viii) cross-associating the second segment with the second segment dimension annotation.

9. The method of claim 7, further comprising the step of:

(a) determining if the new target object is adjacent to any other target object.

10. The method of claim 9, further comprising the step of:

(a) selecting a target object;

(b) inputting modified coordinate position data for the selected target object;

(c) displaying the selected target object in accordance with the modified coordinate position data;

(d) modifying the dimension annotation data corresponding to the selected target object, the modification correlated to the modified coordinate position data; and

(e) displaying a modified dimension annotation correlated to the modified dimension annotation data.

11. The method of claim 10, further comprising the step of:

(a) if the selected target object is adjacent to at least one other adjacent target object:

(i) adjusting the coordinate position data corresponding to the adjacent target object, wherein the adjustment is correlated to the modified coordinate position data;

(ii) displaying the adjacent target object in accordance with the adjusted coordinate position data;

(iii) adjusting the dimension annotation data corresponding to the adjacent target object, wherein the adjustment is correlated to the adjusted coordinate position data; and

(iv) displaying a dimension annotation correlated to the adjusted dimension annotation data.

12. The method of claim 7, wherein step (a) further comprises the steps of:

(a) determining whether the new target object superposes any other underlying target object; and

(b) wherein if the new target object superposes an underlying target object:

(i) creating at least one on-center dimension annotation data correlated to both the coordinate position data of the new target object and the coordinate position data of the underlying target object,

(ii) displaying an on-center dimension annotation correlated to the on-center annotation data,

(iii) cross-associating the new target object with the on-center dimension annotation, and

(iv) cross-associating the underlying target object with the on-center dimension annotation.